



## Foreword

### Introduction to the special issue on molecular spectroscopy, atmospheric composition and climate change



Changes to the Earth's climate system resulting from modification of the atmosphere caused by both anthropogenic and natural effects are one of the great long-term threats to our society. In order to measure and understand the drivers of these changes, quantitative field measurements combined with precise and accurate laboratory data are needed. The Kyoto Protocol [1], signed in 1997, focused the scientific community on the need for data aimed at developing a better understanding of the physics and chemistry of molecular and aerosol species that lead to long-term climate change. The results have been impressive. Continuous and extensive concentration measurements are now being performed from the ground, e.g. the TCCON network, from balloons and airplanes and, of course, from space (e.g. ACE-Scisat, TANSO-GOSAT, IASI-Metop, OCO-2, Sentinel-5P, ...). With the observing system now in place the concentration profiles of a suite of species, including greenhouse gases, aerosol precursors and others are measured with increasing precision over large areas of the Earth, leading to a much more complete understanding of the radiative forcing budget.

These new *in-situ* and remote sensing data place great demands on the laboratory spectra required for calibration and interpretation of the field measurements. Many recent efforts have been devoted to the laboratory measurement of high-resolution molecular spectra of molecules of atmospheric interest with the aim of establishing line positions and shapes as accurately as possible, as well as to theoretical developments and modeling. Some new innovative techniques for local measurements have also been developed.

This special issue of the *Journal of Molecular Spectroscopy* highlights recent advances in high-resolution spectroscopy and other techniques, applied to atmospheric trace gases whose chemical or physical properties are likely contributors to climate change

processes. The issue contains a series of 19 papers covering these different aspects. Firstly, 11 articles are devoted to laboratory measurements, analyses and modeling of a series of strongly absorbing greenhouse gases, some of them being of anthropogenic origin only. Measurements and modeling concern not only line positions and transition intensities, but also line broadening effects. Next, 4 papers deal with some other gases which also influence climate, including aerosol precursors. Finally, 4 papers present innovative *in situ* measurement and diagnostic techniques.

## Reference

[1] [http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php).

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